1858MNRAS..19...29W

evening of the 5th of October. The telescope employed by Mr. Grove was a small instrument of only two inches aperture, and his remarks are offered under an impression that the weather was not generally favourable for observing the comet on the interesting occasion to which they refer:—

"When the comet had entered well within the margin of the tail a dark notch was formed cutting out a portion of the tail round the star; and as the star got further in, this became a dark areola surrounding the star, and in diameter equal to about one-tenth of the line of transit. This continued until the star reached the middle; at this part there is a broad dark line which extends from the nucleus to a distance considerably above the point where the star crossed. When *Arcturus* arrived here, this dark space was perfect up to the star, but on the other side the white light of the tail appeared to come quite up to the star; in short, as the bright part of the tail had been darkened in the vicinity of the star, the dark part was brightened, at least so much of it as was on the side furthest from the nucleus.

"I saw the notch again on the opposite side previous to emersion, and then lost it by clouds.

"The effects I have described are, doubtless, optical, and the notch and areola evidently due to the bright light of this star: the effect on the dark central part is not so easy to explain."

Admiral Smyth has forwarded a series of interesting drawings of the comet by Baron De Forester, representing its appearance as seen to the naked eye at Oporto on various evenings included between September 26 and October 15. The drawings are carefully executed upon a dark ground; and as the stars in the vicinity of the comet are laid down, they serve to give a good idea of the varying *apparent* dimensions, and curvature of the tail.

Thoughts on the Formation of the Tail of a Comet.
By J. J. Waterston, Esq.

Any attempt to account for the formation of the tail of a comet upon exact physical principles would be assisted, if, in the drawings of the telescopic appearances of the nucleus and adjacent coma—which are sometimes provided when circumstances are favourable—we were presented with the projection on the plane of vision of the radius vector, and of the tangent to the orbit. In some cases it might be possible to take such observations as would fix the actual curve of the *exterior line* of the tail, referred to the radius vector, passing through the

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centre of the nucleus; *i.e.* supposing the central axis of the tail to be in the plane of the orbit. This line is very marked in the front side of Donati's comet, and might probably be easily fixed by the equatoreal.

If we view the tail as composed of molecules as free from the force of cohesion as the molecules of an uncondensable gas, and raised from the nucleus by the heat of the sun; and that that heat as it strikes upon each molecule is converted into a force centrifugal, that not only effectually counteracts the force centripetal of the sun's gravity, but that greatly exceeds it; such molecules will be quickly removed from the feeble attraction of the nucleus, and assume the motion of bodies entirely free from its influence. This hypothesis is suggested by the mechanical theory as a possibility.

If we inquire as to the centrifugal power of the sun's rays, we may, with the data afforded by modern research, easily compute the accelerative force it is capable of engendering on a single chemical molecule, if their whole heating power were converted into such a force. This is surpassingly great—no less than 800 miles per second! The data are, value of sun's radiation in a solar day equal to 1·8 ft. thickness of ice melted; the mechanical equivalent of which is about 13 lb. raised 1 foot high per second by the heat impinging on a square foot. If this heat impinges on a superficial foot of gold-leaf, one molecule thick (about one 200-millionth of an inch, as deduced from the relation of *capillarity* to *latent heat*, both being the measure of liquid cohesion, the first that of the superficial stratum of molecules, the second that of a cubic mass of molecules), and is converted into an impulsive force in one direction, it would in one second communicate a velocity of 800 miles a second; and in about four minutes a velocity equal to light itself. It is, of course, an extreme case to suppose the whole heat absorbed and converted; but it seems right to have in view the quantitative elements of the question. While the earth's atmosphere absorbs heat from the sun's rays, we have reason to suppose that heat-vibrations are converted into rectilineal velocity of gaseous molecules; but there is no reason to suppose that the impulse is in the specific direction *from* the sun, but equally *from* and *to*, as in vibratory impulses generally. It may be shown that the mechanical equivalent of the solar heat that impinges on the earth amounts to one-hundredth of its gravity towards the sun; so that, if any part of it acted centrifugally, the orbit would be disturbed. The same remark applies to a comet; but it cannot be denied that the phenomena of the tail, more especially as it turns sharp round in the perihelion passage, are such as require for their explanation a very active exhibition of such a centrifugal force as might be engendered by the conversion of heat acting upon single and free molecules.

Oct. 7, 1858.

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